



FUTURE FISHERIES IMPROVEMENT PROGRAM GRANT APPLICATION

All sections must be addressed, or the application will be considered invalid



I. APPLICANT INFORMATION

A. Applicant Name: _____

Mailing Address: _____

City: _____ State: _____ Zip: _____

Telephone: _____ E-mail: _____

B. Contact Person (if different than applicant): _____

Address: _____

City: _____ State: _____ Zip: _____

Telephone: _____ E-mail: _____

C. Landowner and/or Lessee Name
(if different than applicant): _____

Mailing Address: _____

City: _____ State: _____ Zip: _____

Telephone: _____ E-mail: _____

II. PROJECT INFORMATION

A. Project Name: _____

River, stream, or lake: _____

Location: Township: _____ Range: _____ Section: _____

Latitude: _____ Longitude: _____ *within project (decimal degrees)*

County: _____

B. Purpose of Project:

Lolo Creek Zens Channel Restoration

C. Brief Project Description (attach additional information to end of application):

Lolo Creek Zens Channel Restoration

D. Length of stream or size of lake that will be treated: _____

E. Project Budget:

Grant Request (Dollars): \$ _____

Matching Dollars: \$ _____

Matching In-Kind Services:* \$ _____

**salaries of government employees are not considered matching contributions*

Total Project Cost: \$ _____

F. **Attach** itemized (line item) budget – *see budget template*

G. **Attach** specific project plans, detailed sketches, plan views, photographs, maps, evidence of landowner consent, evidence of public support and fish biologist support, and/or other information necessary to evaluate the merits of the project. If project involves water leasing or water salvage complete a *supplemental questionnaire*_(fwp.mt.gov/habitat/futurefisheries/supplement2.doc).

H. **Attach** land management & maintenance plans that will ensure protection of the reclaimed area.

III. PROJECT BENEFITS (attach additional information to end of application):

A. What species of fish will benefit from this project?

B. How will the project protect or enhance wild fish habitat?

C. Will the project improve fish populations and/or fishing? To what extent?

Lolo Creek Zens Channel Restoration

- D. Will the project increase public fishing opportunity for wild fish and, if so, how?

- E. The project agreement includes a 20-year maintenance commitment. Please discuss your ability to meet this commitment.

- F. What was the cause of habitat degradation in the area of this project and how will the project correct the cause?

- G. What public benefits will be realized from this project?

- H. Will the project interfere with water or property rights of adjacent landowners? (explain):

- I. Will the project result in the development of commercial recreational use on the site? (explain):

Lolo Creek Zens Channel Restoration

J. Is this project associated with the reclamation of past mining activity?

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Each approved project applicant must enter into a written agreement with Montana Fish, Wildlife & Parks specifying terms and duration of the project. The applicant must obtain all applicable permits prior to project construction. A competitive bid process must be followed when using State funds.

IV. AUTHORIZING STATEMENT

I (we) hereby declare that the information and all statements to this application are true, complete, and accurate to the best of my (our) knowledge and that the project or activity complies with rules of the Future Fisheries Improvement Program.

Applicant Signature: Kasie Nelson Date: _____

Sponsor (if applicable): _____

Submittal: **Applications must be *signed and received before December 1 and June 1* of each year to be considered for the subsequent funding period.** Late or incomplete applications will be rejected.

Mail to: Montana FWP Fish Management Bureau PO Box 200701 Helena, MT 59620-0701	Email: Michelle McGree mmcgree@mt.gov (electronic submissions must be signed) For files over 10MB, use https://transfer.mt.gov
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Applications may be rejected if this form is modified.

Lolo Creek Zens Channel Restoration
BUDGET TEMPLATE SHEET FOR FUTURE FISHERIES PROGRAM APPLICATIONS

Both tables must be completed or the application will be returned

WORK ITEMS (ITEMIZE BY CATEGORY)	NUMBER OF UNITS	UNIT DESCRIPTION*	COST/UNIT	TOTAL COST	CONTRIBUTIONS			
					FUTURE FISHERIES REQUEST	IN-KIND SERVICES**	IN-KIND CASH	TOTAL
Personnel***								
Data Collection	1	lump	\$7,000	\$ 7,000 -				\$ -
Design	1	lump	\$7,000	\$ 7,000 -				\$ -
Prepare Construction Plan Set	1	lump	\$15,500	\$ 15,500 -		9,500	14,623.81	\$ -
Permitting & Certification	1	lump	\$7,000	\$ 7,000 -				\$ -
Wetland Delineation	1	lump	\$4,000	\$ 4,000 -				\$ -
As built report	1	lump	\$4,000	\$ 4,000 -				\$ -
			Sub-Total	\$ 44,500 -	\$ -	\$ 9,500 -	\$ 35,000 -	\$ 44,500 -
Travel								
Mileage				\$ -				\$ -
Per diem				\$ -				\$ -
			Sub-Total	\$ -	\$ -	\$ -	\$ -	\$ -
Construction Materials****								
improve roads	1	lump	2,500	\$ 2,500 -				\$ -
furnish wood	1	lump	18,000	\$ 18,000 -				\$ -
furnish streambed	2,775	cubic yard	8	\$ 22,200 -				\$ -
large wood structures	10	each	1,250	\$ 12,500 -				\$ -
woody debris treatment	1,800	feet	12	\$ 21,600 -				\$ -
woody debris treatment	825	feet	20.00	\$ 16,500 -				\$ -
beaver analog/alcove	20/1	each	250/1,500	\$ 6,500 -				\$ -
willow cutting	10,500	each	1	\$ 10,500 -		3,376		\$ -
floodplain and wetland treat	6.5	acres	1,500	\$ 9,750 -				\$ -
			Sub-Total	\$ 120,050 -	\$ 56,649 -	\$ 3,376 -	\$ 60,025 -	\$ 120,050 -
Equipment and Labor								
Clear and Grub	1	lump	5,775	\$ 5,775 -		1,225		\$ -
Salvage Vegetation	1	lump	4,500	\$ 4,500 -				\$ -
Construct channel and bed	1,325	feet	40	\$ 53,000 -				\$ -
Shape streambed	1,000	feet	22	\$ 22,000 -				\$ -
Construct side channels	1,298	feet	5	\$ 6,490 -				\$ -
Reconnect side channels	3,469	feet	1	\$ 3,469 -				\$ -
			Sub-Total	\$ 95,184 -	\$ 46,979.50 -	\$ 1,225 -	\$ 46,979.50 -	\$ 95,184 -
Mobilization								
Mobilization, Crew	1	lump sum	18,000	\$ 18,000 -				\$ -
seeding (didn't fit under materials)	8	acres	150	\$ 1,200 -				\$ -
Management	1	lump sum	35,043.18	\$ 49,043.19 -				\$ -
			Sub-Total	\$ 68,243.19 -	\$ 18,371.50 -	\$ -	\$ 49,871.69 -	\$ 68,243.19 -
TOTALS					\$ 122,000 -	\$ 14,101 -	\$ 191,876.19 -	\$ 327,977.19 -

Lolo Creek Zens Channel Restoration
BUDGET TEMPLATE SHEET FOR FUTURE FISHERIES PROGRAM APPLICATIONS

OTHER REQUIREMENTS:

All of the columns in the budget table and the matching contribution table MUST be completed appropriately or the application will be invalid. Please see the example budget sheet for additional clarification.

*Units = feet, hours, inches, etc. Do not use lump sum unless there is no other way to describe the costs.

**Can include in-kind materials. Justification for in-kind labor (e.g. hourly rates used for calculations). Describe here or in text.

Reminder: Government salaries cannot be used as in-kind match

***The Review Panel suggests that design and oversight costs associated with a proposed project not exceed 15% of the total project budget. If design and oversight costs are in excess of 15%, applications must include a minimum of two competitive bids for the cost of undertaking the project.

****The Review Panel recommends a maximum fencing cost of \$1.50 per foot. Additional costs may be the responsibility of the applicant and/or partners.

MATCHING CONTRIBUTIONS (do not include requested funds)

CONTRIBUTOR	IN-KIND SERVICE	IN-KIND CASH	TOTAL	Secured? (Y/N)
	\$ -	\$ -	\$ -	
Department of Environment 319 Grant	\$ -	\$ 191,876.19 -	\$ 191,876.19 -	N but applied
Lolo Watershed Group	\$ 9,500 -	\$ -	\$ 9,500 -	Y
Private Landowner	\$ 4,601 -	\$ -	\$ 4,601 -	Y
	\$ -	\$ -	\$ -	
	\$ -	\$ -	\$ -	
	\$ -	\$ -	\$ -	
	\$ -	\$ -	\$ -	
	\$ -	\$ -	\$ -	
	\$ -	\$ -	\$ -	
TOTALS	\$ 1401 -	\$ 191,876.19 -	\$ 205,977.19 -	

Lolo Creek Zens Channel Restoration



307 State Street
P.O. Box 1956
Hamilton, Montana 58940
Phone: 406-363-2353, Fax: 406-363-3015
<http://www.geumconsulting.com>

TO: Kascie Herron, Lolo Watershed Group

FROM: Amy Sacry, Senior Restoration Ecologist/Biologist, Geum Environmental Consulting, Inc.
Marisa Sowles, Water Resource Specialist, Geum Environmental Consulting, Inc.

DATE: September 3, 2019

RE: Lolo Creek Zens Restoration Concept

The Montana Department of Environmental Quality (DEQ) has selected the Bitterroot Watershed as the target to receive the bulk of DEQ 319 project grant funding for the next two to three years. This funding, which the states receives under the Clean Water Act, is made available for projects designed to mitigate the effects of non-point source pollution. Lolo Creek is a tributary to the Bitterroot Watershed located near Lolo, Montana. Lolo Creek and many of its tributaries are listed as impaired waterbodies by DEQ. Upper and Middle Lolo Creek are on the 303(d) list for sediment and Total Maximum Daily Load (TMDL) values have been developed as targets for sediment delivery to the stream.

In 2013, the Lolo Watershed Group and partners completed the *Lolo Creek Watershed Restoration Plan*. The purpose of the LWG's WRP was to develop a 5-10 year plan to achieve conservation and restoration goals in the Lolo Creek watershed. The WRP describes the following as primary issues for fisheries, wildlife and water/quality quantity in the watershed:

- Loss of creek meanders due to channelization and confinement by armoring
- Lack of woody debris and diminished wetlands
- Dewatering and fish barriers

The WRP indicates that activities in lower Lolo Creek should include efforts to reach the diverse ownership and other stakeholders through education, outreach, and stewardship activities to help realize the LWG's vision of drought management, surface and ground water quantity improvement, weed reduction, healthy and well established streamside vegetation, proper stream structure and function, and reduction of fish entrainment in irrigation ditches.

The LWG contracted with Geum Environmental Consulting, Inc. (Geum) to help them identify potential projects along the mainstem Lolo Creek where actions could be taken to help meet the goals of the WRP and 319 program. Using aerial imagery, Geum identified several sections of the mainstem river where work could be done. The main criteria for potential site selection included: identified by partner, area to reactivate floodplains (i.e. not heavily channelized and armored), a minimum of 2,000 linear feet of channel on single ownership, signs of degradation obvious on imagery (i.e. low woody vegetation cover, straightened, over-widened, etc.). Based on this initial analysis, Geum identified eight locations where land owner outreach and on the ground site review would be valuable (Attachment A). Of the eight

sites, access was available for three: Mill Creek Streambank and Floodplain (Zens), Earl Tenant (U.S. Forest Service), and Mormon Creek Bridge (Hendrickson).

On August 26, 2019, Geum staff, Kascie Herron with LWG, and Eric Trum with DEQ, visited these sites to evaluate potential to implement restoration actions that meet WRG goals and would be appropriate for targeted 319 funding. Mormon Creek Bridge was determined to be a low priority as it would only include streambank stabilization, and has not significantly changed in the last 10 years. Earl Tenant was determined to have high restoration potential, but a project on private land was preferred to help meet LWG's goal of outreach within the watershed. The group discussed reaching out to the Forest Service to start the process of developing a project at Earl Tenant for 319 funding in November, 2020. The Mill Creek Streambank and Floodplain area located on the Zens property was determined to have high potential to meet both LWG and DEQ goals for Lolo Creek. Therefore, the remainder of this memo presents initial conceptual restoration actions for the Zens property.

Zens Property Existing Conditions

An overview of Lolo Creek on the Zens property is provided in Figure 1. The Zens property includes approximately 3,330 feet of Lolo Creek. The primary impairments to the stream include: channel confinement with riprap, channel straightening, channel over-widening, grazing that has reduced riparian vegetation cover, loss of instream cover (pools and woody debris, and accelerated streambank erosion.

The upper 250 feet of Lolo Creek on the property flows along Highway 12, which is stabilized by riprap (Figure 2). Upstream of the access bridge there is active lateral erosion on the right streambank that is progressing towards the access road south of the bridge. Downstream of the bridge, and likely as a result of channel stabilization, the channel has straightened and over-widened and consists of a long, shallow riffle with little in stream cover (Figure 3). The channel appears to still have good connection with the floodplain through this straightened section and the landowner indicated that out of bank flooding still frequently occurs south of the channel in this area. Riparian vegetation cover and diversity have been reduced by long term grazing in this area. Immediately along the channel, riparian vegetation is more diverse, with several age classes of cottonwoods and willows establishing on recent depositional features.

Downstream of the straight section, the channel turns to the north and the right bank is stabilized with large rock (Figure 4). Some active erosion is occurring at the upstream end of this berm in response to wood accumulation and beaver activity. The berm disconnects the channel from a diverse floodplain area with several historic over flow channels that have transitioned into floodplain wetlands (Figure 5). This diverse floodplain area extends from the north bend of the stream downstream to the end of the Zens property. Downstream of the berm active side channels with sign of recent beaver activity connect to the disconnected floodplain area (Figure 6). South of this area is a large horse pasture with several historic channel meander scrolls that support wetter vegetation (Figure 7).

The downstream most meander on the property is actively eroding into a low floodplain terrace (Figure 8). Streambank stabilization treatments, including log and rock vanes and rootwad revetments, were installed along this bank circa 2003 to reduce the accelerated lateral erosion. These treatments have since eroded out and the bank is poorly vegetated and continues to actively erode.

Lolo Creek Zens Channel Restoration



Figure 1. Overview of Zens Property on Lolo Creek.



Figure 2. Riprap downstream of access bridge.



Figure 3. Over-widened, straight section of channel downstream of bridge.



Figure 4. Rock berm on right bank at north meander bend.



Figure 5. Disconnected floodplain channel that has converted to wetland vegetation.



Figure 6. Side channel with current beaver activity.



Figure 7. Historic floodplain south of Lolo Creek at downstream end of property with old channel meander scrolls.



Figure 8. Downstream meander with active erosion.

Zens Property Restoration Actions

This section presents potential restoration actions and conceptual restoration action lay-outs for the Zens property. This information is provided to LWG to facilitate coordination with the landowner and DEQ and determine the level of project they are interested in pursuing at the site. This concept will be refined based on feedback from LWG and other partners. Once feedback is received, the concept will be refined with additional information on proposed treatments, a proposed schedule will be developed, and costs for design and implementation of the work will be estimated. The purpose of the concept and estimated costs are to support funding acquisition for the work.

The goal for restoration at the Zens Property is to maximize channel and floodplain function by increasing channel and floodplain diversity. As described above, the channel largely remains connected to the floodplain, and there are several areas that support good riparian and wetland vegetation and high topographic floodplain diversity. However, the channel is over-widened and lacks diversity, is confined by riprap in areas, and actively eroding in other areas. The restoration actions described in this section propose to increase channel diversity, reduce streambank erosion, and create and re-activate diverse floodplain areas.

Two scenarios were developed for applying restoration actions to the site. The first scenario represents a maximum restoration scenario and the second scenario provides an alternative to the maximum scenario and removes some of the more costly restoration action items. Restoration Action Scenario 1 is shown in Figure 9 and Restoration Action Scenario 2 is shown in Figure 10.

The restoration actions identified for the Lolo Creek Zens site are described below:

Relocate Lolo Creek away from Highway 12: The upper approximately 250 feet of Lolo Creek abuts Highway 12. Relocating the channel away from Hwy 12 would increase natural floodplain function and reduce the on-going maintenance and erosion associated with the access road and bridge. This action would require significant earthwork and relocation of or installation of a new access bridge.

Construct channel meanders to increase channel diversity and activate more floodplain area: Loss of creek meanders due to channelization and confinement was identified in the WRP as a primary degradation factor in Lolo Creek. The Zens property provides a good opportunity to increase channel meandering. Constructing channel meanders will increase channel length, provide an opportunity to create channel sections with narrower, deeper dimensions, and increase the area of active, diverse floodplain.

Narrow and deepen the channel: This section of Lolo Creek is shallow and over-widened compared to undisturbed and recent historic conditions. The landowner indicated that 20 years ago the channel was much narrower and deeper than the current condition. This action involves deepening and narrowing the channel through excavation and placement of fill, allowing the creation of pools and maximizing connectivity with existing or restored floodplain areas.

Add large woody debris to the channel and floodplain: A lack of woody debris was identified in the WRP as a primary degradation factor in Lolo Creek. This restoration action would include adding large woody debris to the channel and floodplain in the form of bank structures, channel spanning structures (particularly in side channels and floodplain feeder channel), and floodplain roughness to increase channel and floodplain diversity.

Construct side channel and floodplain feeder channels to increase floodplain diversity and wetlands: Diminished wetlands were identified in the WRP as a primary degradation factor in Lolo Creek. This action includes creating wetlands in segments of the channel that are abandoned when new channel meanders are constructed, and constructing side channels or feeder channels to activate these areas.

Remove berm along streambank to reactivate floodplain: A very diverse area of floodplain is currently disconnected from the channel by the presence of a rock berm, likely constructed to prevent down valley flooding. Removing the berm and allowing floodplain reactivation would increase overall stream and floodplain function by increasing flood water recharge into wetlands increasing water storage, retention of fine sediment, and filtering and slow release of stored groundwater.

Realign the channel away from the eroding streambank at the downstream end of the property. The streambank treatments installed to prevent lateral erosion at the downstream end of the property are no longer functioning and the bank is bare, vertical, and actively eroding. Instead of re-building the bank in its current location, this restoration action includes moving the channel to the south and re-building a floodplain between the channel and actively eroding bank. Not only will this provide a long-term solution to erosion in this location but will increase connectivity between the channel and diverse floodplain to the north at this location.

Increase floodplain wetland area: Historic channel meanders are present at the downstream end of the property on the south side of the creek. These meander swales support wet vegetation and appear to connect to the floodplain features that were deactivated by construction of the rock berm. This area provides a good opportunity to increase floodplain wetlands that connect to Lolo Creek during high flows. Construction or enhancement of wetlands in this area would also likely provide a good source of fill for the project.

Preserve existing high quality floodplain and riparian areas: There are several areas along the channel or within the existing floodplain that support diverse topography and riparian and wetland vegetation.

Lolo Creek Zens Channel Restoration

These areas include: active side channels, historic floodplain channels that have been disconnected and now support wetland vegetation, historic meander scrolls, and depositional features along the channel. These areas would be preserved or reactivated.

Lolo Creek Zens Channel Restoration

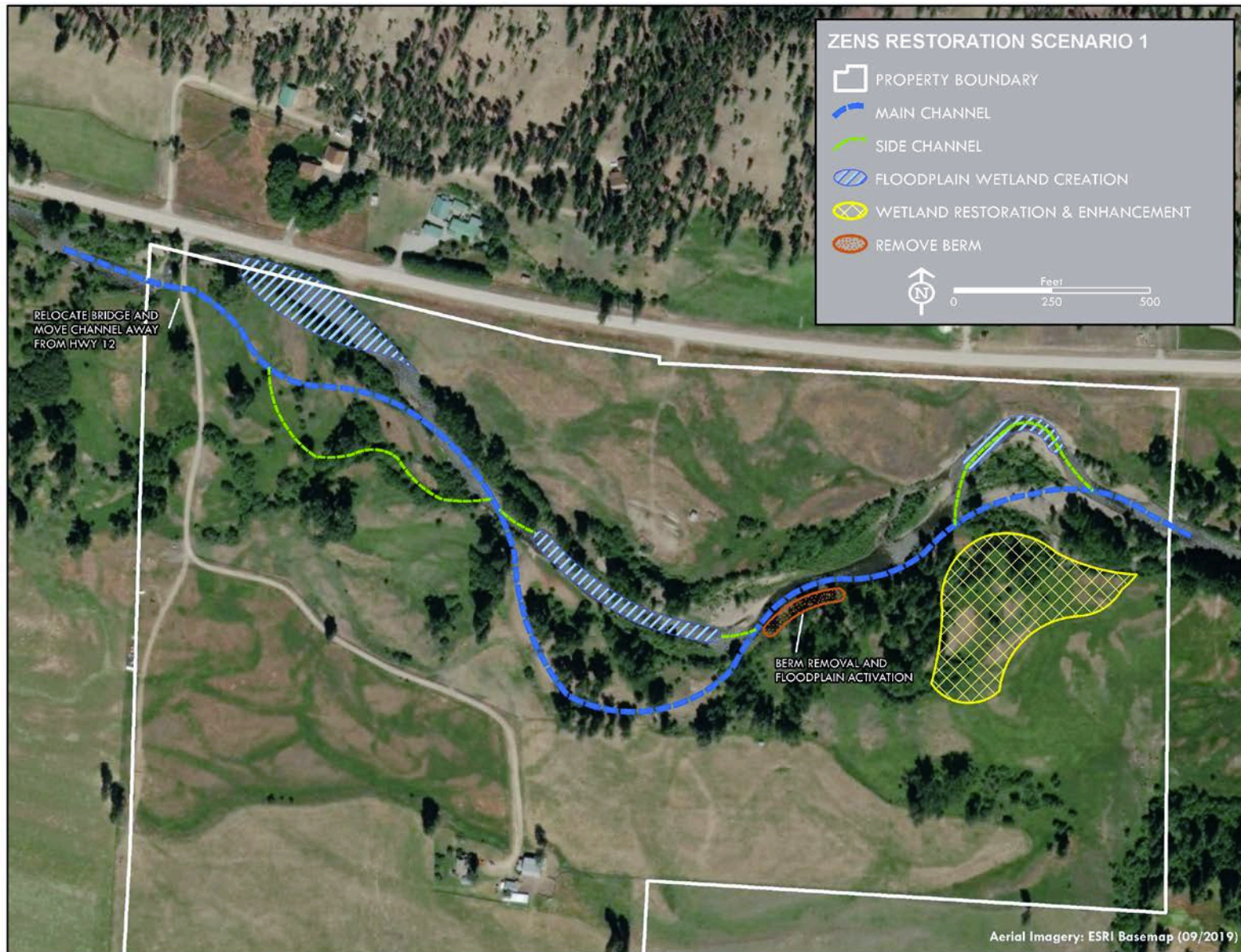


Figure 9. Lolo Creek Zens Site Restoration Scenario 1.

Lolo Creek Zens Channel Restoration

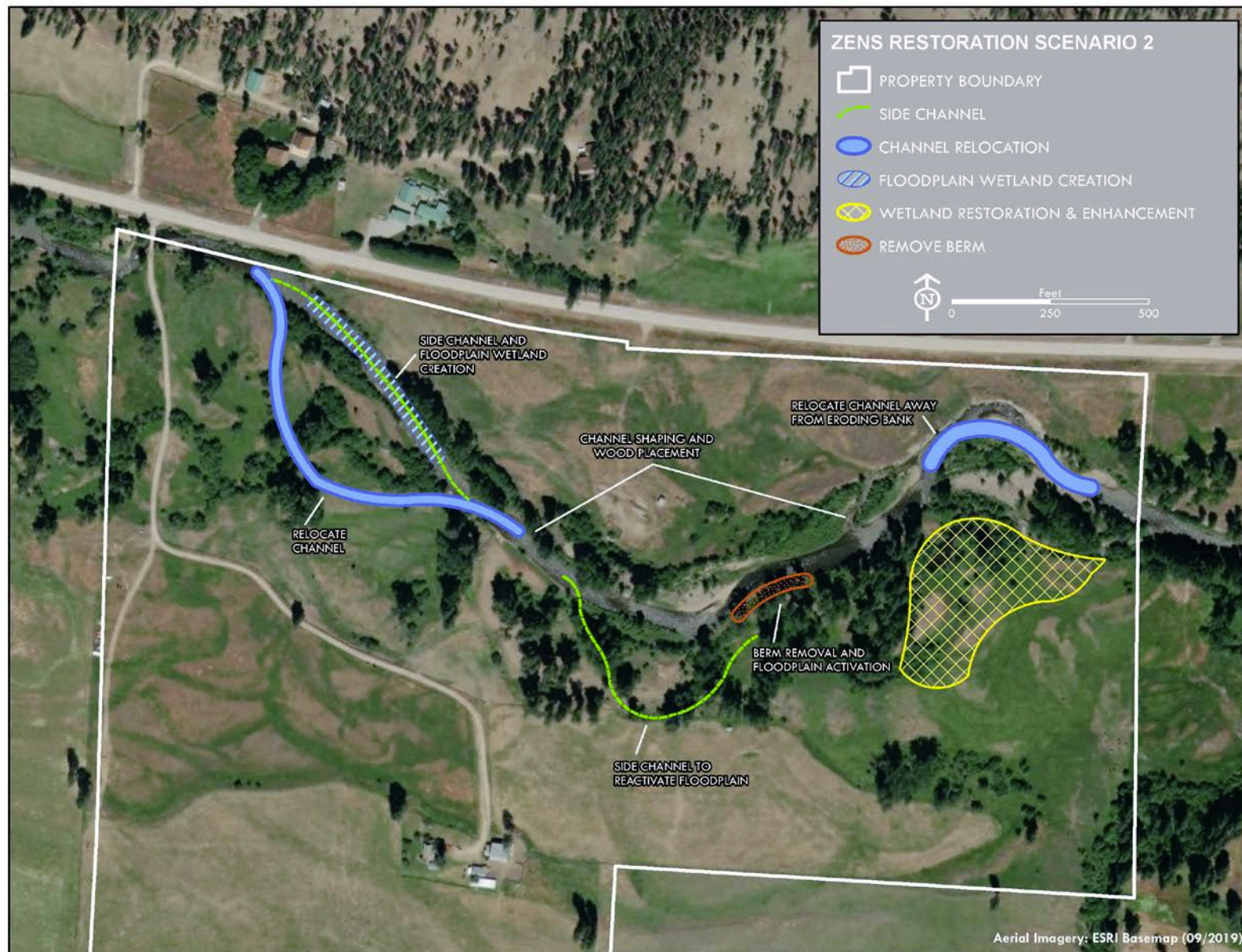


Figure 10. Lolo Creek Zens Site Restoration Scenario 2.

Attachment A. Lolo Creek Potential Restoration Projects

Project Name	Landowner ¹	Project Type
Mormon Creek Bridge	S. Hendrickson (downstream)	Streambank Restoration
Mill Creek Streambank and Floodplain	M. Zens	Channel Meandering, Floodplain/Riparian Enhancement, Streambank Restoration
Potomac Corp	Potomac Corp (OZ or Lolo Creek Ranch)	Channel Meandering, Floodplain/Riparian Enhancement, Large Wood Placement/Aquatic Habitat Enhancement
Bear Creek to Camp Creek	Cummins, U.S. Forest Service, Weyerhaeuser	Floodplain Enhancement, Large Wood Placement/Aquatic Habitat Enhancement
Clark Creek	U.S. Forest Service, Karl L. Tyler	Channel Meandering, Floodplain Enhancement, Large Wood Placement/Aquatic Habitat Enhancement
Potato Gulch Meadow	Karl L. Tyler	Large Wood Placement/Aquatic Habitat Enhancement, Streambank Restoration, Riparian Enhancement
Earl Tenant	U.S. Forest Service	Large Wood Placement, Floodplain Enhancement
Powell Creek Meadow	Beck	Floodplain/Riparian Enhancement, Channel Meandering, Streambank Restoration

¹ Identified based on Montana State Library (MSL) cadastral data

Lolo Creek Zens Channel Restoration

FUTURE FISHERIES IMPROVEMENT PROGRAM Supplemental Design Information Lolo Watershed Group – Zen Restoration Project Concept “Returning Lolo Creek to a Natural State”

Much of the required design information is included in the attached project concept and associated maps and photos. Supplemental information to the project concept is detailed below.

1. Provide a narrative description of the present baseline conditions of the stream and riparian area. Provide a map showing the location of the proposed project. Identify stream type (ephemeral, intermittent, perennial) and stream classification (Rosgen or Montgomery-Buffington methodologies). Provide existing bank-full channel dimensions (width and depth; slope on larger scale projects). Provide photographic documentation of the existing channel, including a photograph of the existing typical channel substrate with an associated ruler for scale.

A complete project narrative that describes the current condition of the project area is attached in the project concept. Along with this narrative is a set of maps of the area, overview and more detailed, as well photographs that document the existing channel and substrate. The stream type is perennial, and the classification is Rosgen C. The existing bank-full channel dimensions are as following: Width (riffle) = 50-55 ft, Depth (riffle) = 1.5-2.0ft, and channel slope = .006 or 6%.

2. Identify the cause(s) of existing impairments on the proposed project reach and describe how the project would restore appropriate conditions.

A complete background on the causes of existing impairments as well as how the project would directly address and restore the area to appropriate conditions is also described in length in the attached project concept.

3. Provide an estimate of design discharge and note the method(s) of estimation. If the proposed design is based on a reference reach, provide specific descriptive information (channel type, bank-full width, and bank-full depth; slope on larger scale projects) and explain applicability to the proposed project reach. Identify the location of any or all reference reaches on a map. Provide photographic documentation of the reference channel.

Estimating design discharge would be a component of the design process (for which we are also applying for match funding to cover). However, we do know how we would determine the discharge. One short-term stream gage was located near the mouth of Lolo Creek from 1950-1960 with additional peak flow measurements through 1974. Given the relatively short period of record, hydrologic statistics would be developed using regional regression equation. Gage statistics would be transposed to the project area using basin-area method and regional regression exponents. A weighted average of the regional regression estimates and gage data would likely be used to provide the most reliable flood frequency estimates.

4. Provide a plan view drawing for the entire reach, showing placement of all structures and proposed treatments (including fencing).

This is also attached in the project concept and concept map.

5. Provide typical drawings for all proposed structures.

Lolo Creek Zens Channel Restoration

Attached in project map.

6. Describe proposed and future land use activities within adjacent riparian areas.

Future land use activities will be consistent with current land use activities. In the adjacent riparian areas there is currently light grazing from horses. In discussions with the landowner, these horses would be removed from the area and would graze elsewhere, and hay would be provided to supplement their diets. Currently there is fencing along the proposed stretch, and part of the maintenance plan would be to mend and strengthen the current fence as needed to ensure success of revegetation efforts.

LOLO CREEK ZENS RESTORATION CONCEPT SUPPLEMENTAL INFORMATION

TREATMENT DESCRIPTIONS:

Construct Channel: Realign and reconstruct the main channel to increase sinuosity, restore narrower and deeper channel dimensions, and increase floodplain connectivity. Channel dimensions would be narrower and deeper than existing conditions. The sinuosity and channel dimensions would support processes such as creation of pools for fish habitat and allow the main channel to access side channels and wetland areas during high flows. Channel construction would also relocate the channel away from an outside meander bend with a tall, vertical, eroding bank that contributes sediment to the main channel, is migrating north toward Highway 12, and is actively incising the channel.

Channel Reshaping: Reshape existing channel in areas where the new design channel overlaps with the existing main channel. This treatment includes shaping the existing channel to have narrow dimensions and more sinuosity. This treatment will increase pool frequency and depth and increase floodplain connectivity.

Streambank Treatments: Streambank treatments would be built along the newly constructed channel and existing channel that is reshaped. Streambank treatments include **Woody Debris Matrix** and **Large Wood Structures**. Woody Debris Matrix treatments are built along all streambanks except point bars. These treatments consist of layers of woody debris, brush, dormant willow cuttings, and a mix of coarse and fine substrate. The purpose of this treatment is to increase near channel roughness to protect banks while willows establish and increase aquatic habitat diversity. Large Wood Structure treatments are built intermittently along outside meander bends and consist of larger wood than woody debris matrix treatments. Large wood structures consist of a mix of large and small wood. One or two large woody structures would be located along an outer meander bend. The large wood directs flow away from the channel bank and supports hydraulic conditions that create and maintain pools for fish refugia. Dormant willow cuttings and mature shrub transplants are integrated into the Large Wood Structures.



Figure 1. Example streambank treatments - woody debris matrix and large wood structure.

Side Channel Construction: Side channels will be constructed along the main channel where there is enough width and elevations can support them. Side channels will be designed to be activated at relatively low return flow intervals (i.e. every year), and may be designed to flow year round. Side channels will be constructed to support diverse aquatic habitat such as pools and riffles to increase available habitat for aquatic species. Streambank treatments similar to those constructed along the main channel will also be constructed along side channels.

Existing Distributary Channel Activation: There are several old channel features and scrolls within the project area. Most of these are no longer connected to the main stream channel due to the construction of small levees, bank armoring or channel migration. This treatment includes excavating access points along the main channel to re-activate the existing network of distributary channels to increase floodplain connectivity, invigorate riparian vegetation establishment and expansion and provide overall increased floodplain ecological function, such as flood storage and retention. These distributary channels would be activated at various flows depending on location and existing elevation. Minimal work within the existing distributary channels is anticipated.

Preservation: There are several areas of high quality riparian vegetation establishing along Lolo Creek within the project reach. These areas consist of several age classes of cottonwoods, willows, and other riparian shrubs such as dogwood and alder. These areas will be preserved and integrated into grading plan development.

Channel Fill and Wetland Creation: Segments of the existing channel that are abandoned due to channel realignment will be graded to support diverse wetland and riparian vegetation communities. These abandoned channel segments would not be filled completely but instead graded to an elevation that maintains hydrologic connectivity to baseflows. These areas would recruit native woody riparian species such as willows, cottonwoods, dogwoods and alder. Plugs would be constructed at the upstream and downstream ends of the abandoned main channel segments to avoid recapture by the main channel. Additional plugs may be included within the abandoned main channel to further reduce the risk of capture.

Alcove Enhancement: One backwater feature connected to the main channel is present in the project reach. This backwater is activated during high flows and stores fine sediment and woody debris. As a result, diverse wetland vegetation has established in this area. This area would be preserved and enhanced through increased depth and addition of woody debris to enhance aquatic habitat and support woody riparian growth.

Floodplain Treatment: All areas of newly constructed floodplain or floodplain lowered to activate disconnected distributary channels will be treated to increase diversity and support riparian vegetation community establishment. Some floodplain areas will be lowered to increase hydrologic connectivity with the main channel and provide surfaces for natural recruitment of riparian species such as willow, alder, and cottonwood. All constructed floodplain areas will be roughened topographically and with woody debris to increase and provide short term erosion control. These surfaces will be revegetated by constructing

trenches with dormant willow cuttings and cottonwood pole cuttings, salvaged trees, shrubs, and native sod, and with native seed. Some containerized plants may be installed on floodplain surfaces, but only if sufficient transplants are not available.



Figure 2. Surface Roughness and Woody Debris.

Beaver Dam Analogs: Beaver are currently active in side channels within the project reach. The dams constructed by beaver function to increase floodplain activation, increasing the area available for wetland creation and woody riparian vegetation expansion. These dams also function to slow flood velocities and retain water in the floodplain longer. Structure that mimic the function of beaver dams will be constructed in side channels and re-activated distributary channels. Beaver dam analogs are constructed using woody debris, native cobble and gravel, and dormant willow cuttings.



Wetland Enhancement: Historic floodplain consisting of diverse topography is present on the south side of the channel at the downstream end of the project reach. This area could be enhanced through grading and revegetation to increase wetland area and enhance overall wetland diversity and ecological function.

REVEGETATION PLAN:

The revegetation plan consists of the following components:

- Preservation: Areas along the main channel that support native woody riparian vegetation will be integrated into project grading and preserved.
- Willow cuttings: Dormant willow cuttings will be incorporated into all streambank treatments and constructed floodplain areas.
- Shrub and Sod Transplants: Desirable woody species, such as dogwood, alder, willow, and cottonwood within construction limits will be salvaged and re-used in streambanks or constructed floodplains.
- Seeding: All disturbed areas and newly constructed floodplains will be seeded with seed mixes consisting of desirable native species.
- Containerized Plants: Some containerized plants (cottonwood, dogwood, alder, and willow) may be planted on newly constructed floodplain surfaces if sufficient transplants are not available.

EXAMPLE BEST MANAGEMENT PRACTICES:

Some best management practices will be determined through the permitting process, but typical practices included in construction documents include:

- Construction will occur during seasonal low flow.
- Construction will occur in the dry to the extent possible by constructing clear water diversion channels or isolating work areas.
- All trees, vegetation and land areas not located within project construction, staging or earthwork limits will be protected and care taken to avoid unnecessary damage to natural vegetation.
- Stream crossings will be minimized during construction.
- Equipment will be cleaned of external oil, grease, dirt, and mud, and all leaks will be repaired prior to entering areas that drain directly to streams or wetlands. Equipment will be in a well-maintained condition to minimize the likelihood of a fluid leak. Fluid spill containment equipment will be present on site and ready for use should an accidental spill occur.
- All equipment will be pressure washed prior to arriving on site to reduce potential spread of weeds.
- Fuel storage and refueling will not occur within 300 feet of perennial drainages and wetlands or within 150 of ephemeral drainages. Fuel spill containment and cleanup materials will be present and available on-site.
- Erosion control measures, such as straw bales, straw wattles or silt fence will be installed between construction areas and any live water, wetlands or drainages with potential for live water. A supply of erosion control materials will be kept on hand to respond to sediment emergencies.
- Excavated material stockpiles and equipment staging areas will be designated to minimize soil disturbance and vegetation disturbance, and prevent sediment delivery to streams or wetlands.

Lolo Creek Zens Channel Restoration



Lolo Creek Zens Channel Restoration



Lolo Creek Zens Channel Restoration



Lolo Creek Zens Channel Restoration



ZENS RESTORATION CONCEPT PROJECT LOCATION

Lat: 46.752565; Long: -114.233741
HUC12: Lower Lolo Creek (170102051409)

 PROJECT LOCATION

Miles 0 0.5 1 1.5 2 2.5

Aerial Imagery: ESRI World Basemap (07/18)



Lolo Creek Zens Channel Restoration

12

TO LOLO, MT ➔

ZENS RESTORATION CONCEPT

Lat: 46.752565; Long: -114.233741

HUC12: Lower Lolo Creek (170102051409)

-  Main channel realignment
-  Side channel construction
-  Existing distributary channel activation
-  Existing main channel
-  Channel fill & Wetland creation
-  Wetland restoration & enhancement
-  Floodplain lowering & treatment
-  Alcove enhancement
-  Property boundary (Kimberly Maria Anne Zens)

Figure scale 1:3,000

Feet
0 250 500

Aerial Imagery: ESRI World Basemap (07/18)



Lolo Creek Zens Channel Restoration



Lolo Creek Zens Channel Restoration

12

TO LOLO, MT

ZENS - MAIN CHANNEL REALIGNMENT

- Main channel realignment
- Side channel construction
- Existing distributary channel activation
- Existing main channel
- Property boundary

0 250 500 Feet

Aerial Imagery: ESRI Basemap (09/2019)



Lolo Creek Zens Channel Restoration

12

TO LOLO, MT

ZENS - SIDE CHANNEL ALIGNMENTS

- Main channel realignment
- Side channel construction
- Existing distributary channel activation
- Existing main channel
- Property boundary

